

CLAIMS

1. A method for manufacturing multilayer capacitor comprising:
a capacitor element housed in an outer case, the capacitor element being comprised of a plurality of metal foils alternately stacked with electrically insulating separators interposed therebetween, the metal foils partly comprising connecting portions; and
the connecting portions connected respectively to a positive electrode external terminal and a negative electrode external terminal; comprising the step of:
electromechanically connecting and combining each connecting portion of each stacked metal foil by friction stir welding.
2. The method for manufacturing multilayer capacitor of claim 1, wherein a reinforcing base material is placed at least at one side of each of the stacked connecting portions to carry out the friction stir welding of the connecting portions.
3. The method for manufacturing multilayer capacitor of claim 2, wherein the reinforcing base material works as an internal electrode.
4. The method for manufacturing multilayer capacitor of claim 2 or 3, wherein the friction stir welding is carried out from the side where the reinforcing base material is placed.
5. The method for manufacturing multilayer capacitor of any one of claims 2 to 4, wherein a same metal material as the metal foils is used as the reinforcing base material.
6. The method for manufacturing multilayer capacitor of any one of claims 1 to 5, wherein a welding base material made of a same metal as the metal foils and having almost a same thickness as or being thicker than multilayer bodies formed by stacking the metal foils comprising the connecting portions is positioned adjacent to at least one part of a stacking side face of each of the multilayer bodies, and at least one part of a boundary

between the welding base material and the multilayer body is stirred by a rotating probe to form a weld zone.

7. The method for manufacturing multilayer capacitor of claim 6, wherein the probe is press-fitted into the boundary between the welding base material and the multilayer body, or vicinity of the boundary, along a boundary face.

8. The method for manufacturing multilayer capacitor of claim 6 or 7, wherein the welding base material comprises at least an almost homogeneous block body made of the same metal as the metal foils stacked in the multilayer body.

9. The method for manufacturing multilayer capacitor of any one of claims 6 to 8, wherein the welding base material comprises at least a multilayer body of metal foils not comprising oxide layers formed by a formation process on their surfaces.

10. The method for manufacturing multilayer capacitor of any one of claims 6 to 9, wherein the welding base material is positioned adjacent to a cut-away part formed in a circumference of the multilayer body, or an internal surface of a hole penetrated in a stacking direction such that almost all the metal foils stacked in the multilayer body are penetrated.

11. The method for manufacturing multilayer capacitor of claim 10, wherein the probe is shaped such that the probe rotates to weld at least one part of opposing boundaries out of boundaries between the welding base material positioned adjacent to the cut-away part or the internal surface of the hole, and the multilayer body, at the same time.

12. The method for manufacturing multilayer capacitor of any one of claims 6 to 11, wherein the multilayer body is positioned adjacent to an internal surface of a cut-away part formed at the welding base material.

13. The method for manufacturing multilayer capacitor of any one of claims 6 to 12, wherein the probe is press-fitted such that the weld zone

welded by the probe is formed more in a welding base material side.

14. The method for manufacturing multilayer capacitor of any one of claims 6 to 13, wherein the probe is press-fitted into almost a same direction as the stacking direction of the multilayer body.

15. The method for manufacturing multilayer capacitor of any one of claims 6 to 13, wherein the probe is press-fitted into a direction almost perpendicular to the stacking direction of the multilayer body.

16. The method for manufacturing multilayer capacitor of any one of claims 6 to 15, wherein a reinforcing base material made of the same metal as the metal foils and being thicker than the metal foil is positioned abutting the multilayer body, and one part of the reinforcing base material is welded with the multilayer body by the friction stir welding.

17. The method for manufacturing multilayer capacitor of claim 16, wherein the welding base material and the reinforcing base material are integrated.

18. The method for manufacturing multilayer capacitor of claim 17, wherein a reinforcing welding base material integrating the welding base material and the reinforcing base material is of an L-shape in a sectional view, or of a U-shape, with at least one side opened, in a sectional view.

19. The method for manufacturing multilayer capacitor of any one of claims 6 to 18, wherein the reinforcing base material being thicker than the metal foil is interposed between one part of the metal foils stacked in the multilayer body.

20. The method for manufacturing multilayer capacitor of any one of claims 6 to 19, wherein the metal foils comprise the oxide layers formed by the formation process, or polarizable electrode layers made primarily of activated charcoal or carbon, on their surfaces at least except the connecting portions.

21. A multilayer capacitor, wherein it is manufactured by using the method for manufacturing multilayer capacitor of any one of claims 1 to 20.